

Project Report

AAFC National Potato Variety Trial Results from CDCS, Brooks, AB 2017

Prepared for:
Funding agencies and industry sponsors

Prepared by:

Michele Konschuh¹ and Benoit Bizimungu²

¹Alberta Agriculture and Forestry
Crop Diversification Centre South
301 Horticultural Station Road East
Brooks, AB T1R 1E6

²Agriculture and Agri-Food Canada
Potato Research Centre
850 Lincoln Road P.O. Box 20280
Fredericton, NB E3B 4Z7

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Introduction

In Alberta, potato industry stakeholders are looking for replacement varieties that use less nitrogen, less water, less pesticide, yet yield superior processing or culinary quality and tonnage. Varieties from breeding programs in Canada, Europe and the United States are often being assessed. Many breeding programs target disease resistance, nitrogen use efficiency and excellent storage potential in addition to increased yield. Tuber yield potential and nutritional requirements are impacted by variety characteristics and by environmental characteristics such as the length of the growing season (Westermann, 1993). As noted by Love et. al (2003), the full potential of a new variety may not be realized until proper management is implemented. There is increasing pressure on potato producers to utilize best management practices to reduce the environmental footprint for potatoes. The costs of such shifts in production practices will be borne primarily by producers.

An ideal French fry variety would have earlier maturity than Russet Burbank, be relatively tolerant of environmental fluctuations, have few defects, yield well and have specific gravity in the desired range (1.086 to 1.092). Good fry color out of the field is an asset, and good fry color out of storage is also very desirable. An ideal chipping variety would produce a good yield of medium sized tubers, be relatively tolerant of environmental fluctuations, have few defects, and have high specific gravity in the desired range (above 1.086). Tubers with a good skin set, good maturity at harvest and low concentration of reducing sugars is also very desirable. Varieties that store well at cooler temperatures are an asset. Ideal fresh market varieties would produce a good yield of creamer or medium sized tubers, be relatively tolerant of environmental fluctuations, have few defects, and have an attractive appearance. Tubers with a good skin set that store well are very desirable.

The purpose of this project was to pool resources to evaluate potential varieties from a range of sources, using a cooperative approach. This trial was established to collect local agronomic data on varieties from breeding programs in Canada, the U.S. and elsewhere. The varieties were planted in replicated plots at the Crop Diversification in Brooks, AB and were provided with 209 lbs/ac N. Alberta data is essential when selecting varieties appropriate for our climate, our customers and industry stakeholders.

Objectives

- A. To evaluate new cultivars for French fry processing;
- B. To evaluate new cultivars for chip processing;
- C. To evaluate new cultivars for fresh consumption; and
- D. To evaluate cultivars from AAFC's National Potato Breeding Program under Alberta conditions.

Materials and Methods

The variety evaluation was conducted in small plots at the Crop Diversification Centre South in Brooks, AB. Fertility for the AAFC plots (209 lbs/ac) was achieved through a combination of soil fertility (83 lbs/ac N; 253 lbs/ac P) and broadcast fertilizer (86 lbs/ac of 11-52-0) incorporated May 4 prior to planting. AAFC plots received an additional top-dressing (254 lbs/ac of 46-0-0) at hilling (June 8), for a total of 209 lbs/ac N. Entries were planted in duplicate rows in a randomized complete block design along with standard varieties. Each block was planted adjacent to guard rows to reduce any edge effects (see plot plan, Appendix A).

Eptam 8E (1.8 L/ac) was applied prior to planting (May 4) to control weeds. Seed of standard cultivars and test cultivars was provided by AAFC. Potatoes were planted May 16 approximately 12 to 15cm deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart. Plots were hilled June 3 with a power tiller. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied twice during the growing season to prevent early and late blight from developing (Table 1). Insecticide (Coragen; 151mL/ac) was applied July 25 to control Colorado Potato Beetle.

Table 1: Foliar fungicides applied to the potato crop in 2017 to prevent early and late blight development.

<i>Date of Application</i>	<i>Fungicide</i>	<i>Rate</i>
7 July	Ridomil Gold/Bravo	0.83L/ac
25 July	Quadris	324mL/ac



Figure 1: Variety evaluation trial at CDCS in Brooks, AB July 8, 2017.

Reglone was applied (1.0 L/ac) August 25, 2017. Potatoes were harvested September 6 and 7 using a 1-row Grimme harvester.

Fresh market and French fry tubers were stored at 8°C until graded. Chipping tubers were stored at 14.5°C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, over 88mm and deformed). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. Sub-samples of 48-88mm tubers were provided to Lethbridge Research Centre staff for culinary and post-harvest evaluations.

The data presented here have not been statistically analyzed. Data reported are the mean of two replicate rows.

Results – Chipping Cultivars

Sample hills of each cultivar were dug for a field day August 24, 2017. Photos of the chipping cultivars are shown in Figure 2.

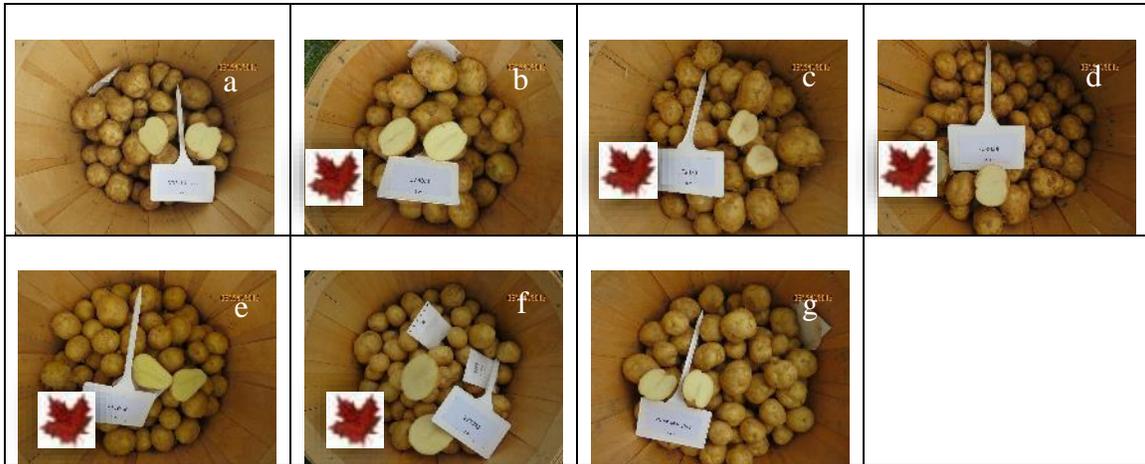


Figure 2. AAFC chipping cultivars at the CDCS field day August 24, 2017: a) Atlantic E, b) F13026, c) F13033, d) F13034, e) F13036, f) F13039, and g) Snowden East.

Yield data (total yield; ton/ac) and specific gravities of each of the chipping cultivars are shown in Table 2. Yield ranged from 18.4 for F13036 to 31.6 ton/ac for F13034. Specific gravity ranged from 1.082 for F13026 to 1.100 for Atlantic East.

Table 2: Estimated total yield (ton/acre) and specific gravity for each chipping cultivar grown at CDCS in Brooks, AB (approximately 209 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
Atlantic East	26.1	1.100
F13026	28.7	1.082
F13033	18.5	1.087
F13034	31.6	1.090
F13036	18.4	1.084
F13039	25.5	1.087
Snowden East	24.4	1.093

The mean percentage of total tuber number in each size category is shown in Table 3.

Table 3: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each chipping cultivar grown at approximately 209 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
Atlantic East	27	66	6	1
F13026	18	77	4	1
F13033	34	65	1	0
F13034	34	63	3	1
F13036	41	58	0	1
F13039	31	66	2	1
Snowden East	33	66	1	0

The yield of tubers (estimated ton/ac) of each chipping cultivar is shown by size category in Table 4. Marketable yield ranged from 15.0 ton/acre for F13033 to 24.6 ton/ac for F13034.

Table 4: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each chipping cultivar grown at approximately 209 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Atlantic East	2.2	18.1	5.6	0.2
F13026	3.2	23.2	3.5	0.3
F13033	2.8	15.0	0.7	0.0
F13034	4.0	24.6	2.8	0.3
F13036	3.5	14.6	0.1	0.1
F13039	3.1	20.5	1.5	0.5
Snowden East	3.4	20.2	0.7	0.0

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Hollow heart or brown center was noted in a few tubers. Several tubers has black scurf lesions, but few had common scab lesions.

Results– French Fry Cultivars

Sample hills of each cultivar were dug for a field day August 24, 2017. Photos of the French fry cultivars are shown in Figure 3.

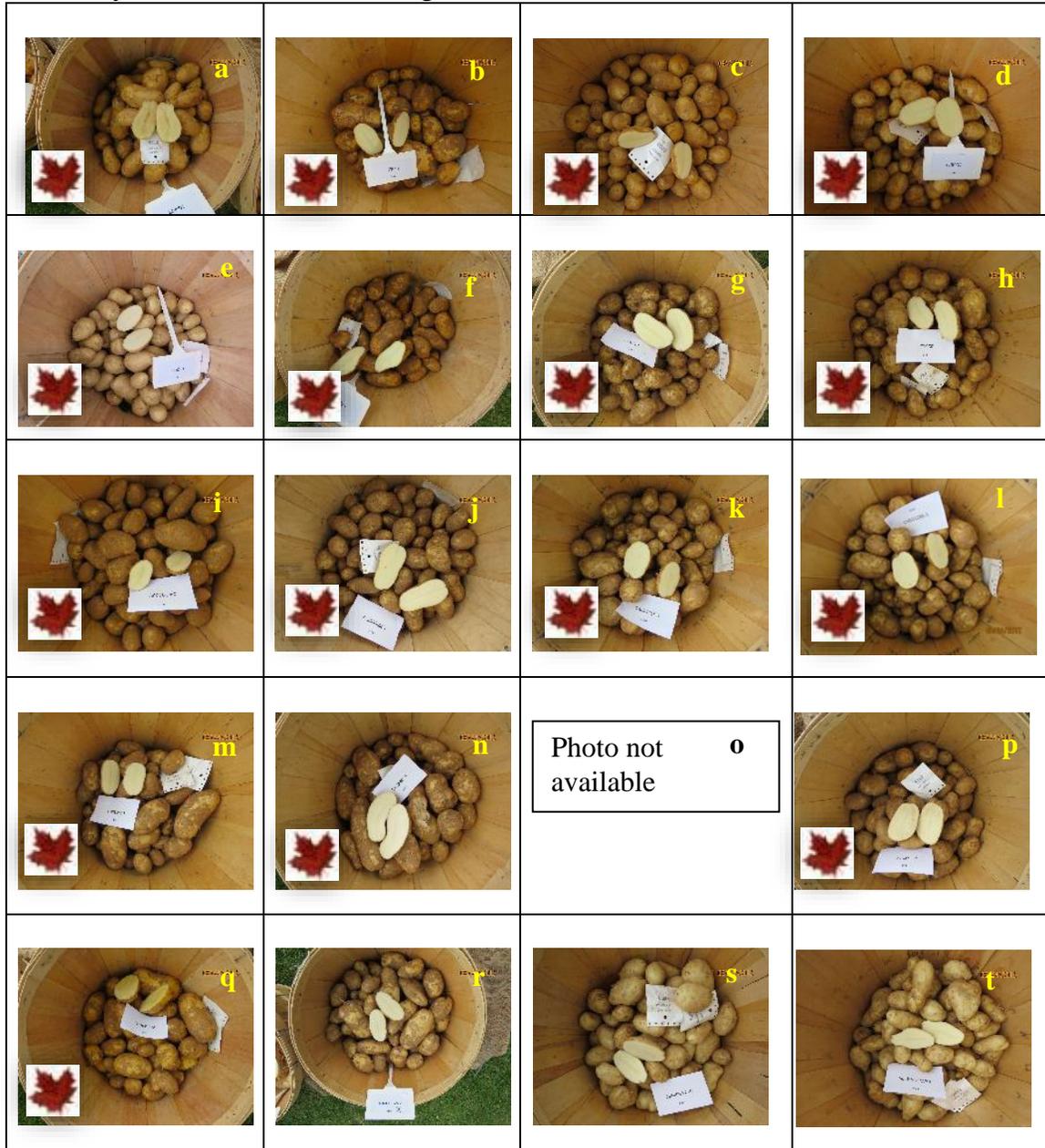


Figure 3. AAFC French fry cultivars at the CDCS field day August 24, 2017: a) F13004., b) F13007, c) F13008, d) F13009, e) F13010, f) F13014, g) F13015, h) F13020, i) CV011010-1, j) CV011188-1, k) CV011286-1, l) CV011295-1, m) CV03366-1, n) CV08087-2, o) CV10045-2, p) CV10121-1, q) FV16028-03, r) Russet Burbank, s) Shepody E, and t) Shepody W.

Yield data (total yield; ton/ac) and specific gravities of each of the French fry cultivars are shown in Table 5. Total yield ranged from 19.2 ton/ac for CV10121-1 to 31.6 ton/ac for Shepody West. Specific gravity ranged from 1.072 for CV08087-2 to 1.099 for F13009.

Table 5: Estimated total yield (ton/acre) and specific gravity for each French fry cultivar grown at CDCS in Brooks, AB (approximately 209 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
F13004	28.2	1.091
F13007	26.8	1.079
F13008	24.2	1.095
F13009	29.0	1.099
F13010	28.4	1.078
F13014	24.9	1.090
F13015	27.3	1.088
F13020	21.7	1.086
CV011010-1	22.8	1.080
CV011188-1	24.3	1.095
CV011286-1	25.8	1.078
CV011295-1	25.7	1.077
CV03366-1	21.4	1.089
CV08087-2	23.2	1.072
CV08253-1	26.2	1.078
CV10045-2	24.1	1.076
CV10121-1	19.2	1.089
FV16028-03	23.1	1.082
R.Burbank East	25.0	1.089
R.Burbank West	29.0	1.080
Shepody East	25.6	1.084
Shepody West	31.6	1.085

The mean percentage of total tuber number in each size category is shown in Table 6.

Table 6: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each French fry cultivar grown at approximately 209 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
F13004	34	61	0	5
F13007	26	72	1	1
F13008	42	57	0	2
F13009	41	57	0	1
F13010	30	68	0	2
F13014	21	79	0	0
F13015	29	70	0	1
F13020	35	64	0	1
CV011010-1	33	67	0	1
CV11188-1	46	49	0	5
CV011295-1	19	77	0	3
CV03366-1	53	45	0	2
CV08087-2	26	64	3	6
CV08253-1	36	59	1	4
CV10045-2	28	63	0	9
CV10121-1	42	56	0	2
FV16028-03	26	67	0	7
R.Burbank East	37	59	0	5
R.Burbank West	33	53	0	14
Shepody East	38	47	1	15
Shepody West	28	69	0	3

The yield of tubers (estimated ton/ac) of each French fry cultivar is shown by size category in Table 7. Yield of 48 – 88mm tubers ranged from 14.7 ton/ac of CV03366-1 to 26.2 ton/ac of Shepody West.

Table 7: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each French fry cultivar grown at approximately 209 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
F13004	3.5	21.4	0.4	3.0
F13007	2.2	23.0	1.4	0.1
F13008	4.7	18.7	0.0	0.8
F13009	6.2	22.4	0.0	0.4
F13010	2.9	24.8	0.0	0.7
F13014	2.0	22.9	0.0	0.0
F13015	3.5	23.2	0.0	0.6
F13020	2.9	18.4	0.0	0.4
CV011010-1	3.4	18.9	0.0	0.4
CV01188-1	5.6	17.0	0.0	3.4
CV011286-1	3.7	21.8	0.0	0.3
CV011295-1	1.6	22.6	0.0	0.5
CV03366-1	6.0	14.7	0.0	0.7
CV08087-2	1.4	17.6	2.4	1.8
CV10045-2	1.9	18.0	0.0	4.2
CV10121-1	4.0	14.8	0.0	0.4
FV16028-03	1.5	19.2	0.1	2.3
R.Burbank East	3.4	19.2	0.0	2.4
R.Burbank West	3.0	20.8	0.0	5.1
Shepody East	3.8	15.4	0.7	5.7
Shepody West	2.9	26.2	0.2	2.2

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Hollow heart was noted in one tuber of WV10075rus-1 and one Russet Burbank tuber. Some tubers from each sample exhibited stem-end discoloration and this may indicate the presence of wilt organisms. Black scurf was only noted on individual tubers of F12011 and Russet Burbank.

Results – Fresh Market Cultivars

Sample hills of each cultivar were dug for a field day August 24, 2017. Photos of the yellow/white fresh market cultivars are shown in Figure 4.

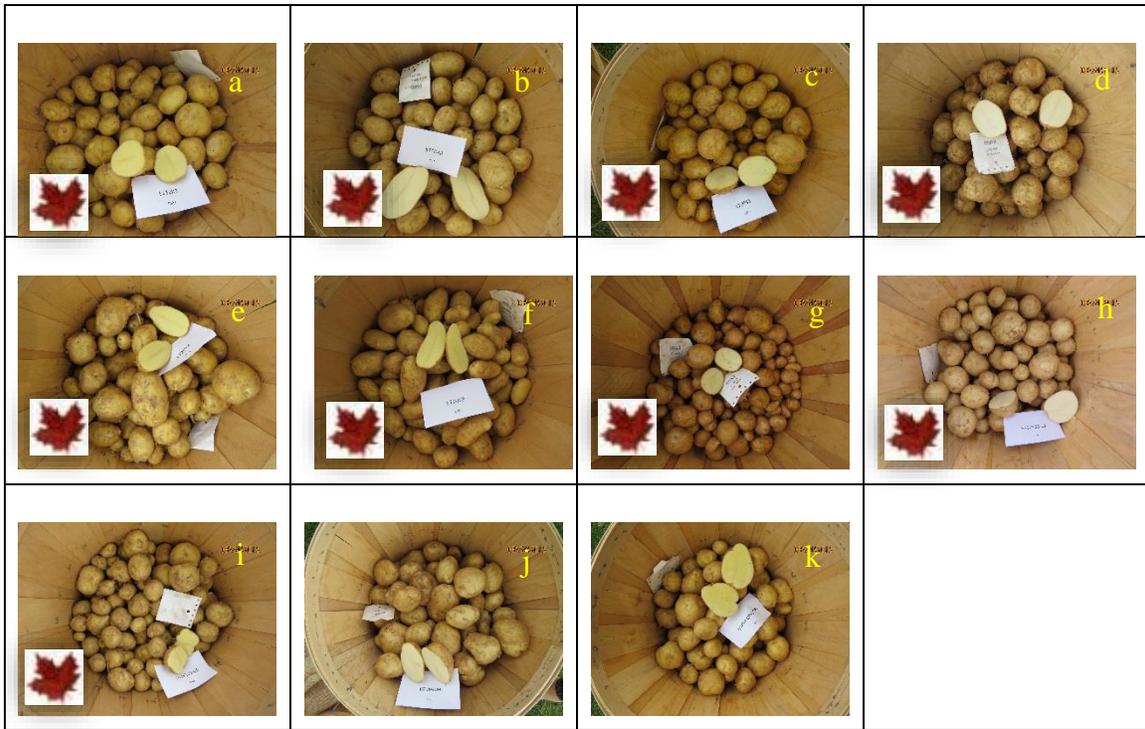


Figure 4. AAFC yellow/white fresh market cultivars at the CDCS field day August 24, 2017: a) F12051, b) F12059, c) F13047, d) F13058, e) F13063, f) F13065, g) F13072, h) FV16210-18, i) FV16213-02, j) Kennebec, and k) Yukon Gold East.

Photos of the purple/red-skinned fresh market cultivars are shown in Figure 5.



Figure 5. AAFC purple/red-skinned fresh market cultivars at the CDCS field day August 24, 2017: a) F12057, b) F12062, c) F12077, d) F13049, e) F13050, f) F13051, g) F13053, h) F13054, i) F13060, j) Chieftain East, and k) Norland E.

Yield data (total yield; ton/ac) and specific gravities of each of the fresh market cultivars are shown in Table 8. Total yield ranged from 21.2 ton/ac for F13072 to 35.4 ton/ac for Norland E. Specific gravity ranged from 1.068 for Norland to 1.091 for F13047.

Table 8: Estimated total yield (ton/acre) and specific gravity for each fresh market FM) cultivar grown at CDCS in Brooks, AB (approximately 209 lbs/ac nitrogen). Data shown is the mean of two replicates.

	End Use	Yield (ton/ac)	SG
Yellow/White-skinned			
F12051	FM	29.5	1.082
F12059	FM	26.7	1.084
F13047	FM	29.2	1.091
F13058	FM	33.3	1.079
F13063	FM	22.4	1.082
F13065	FM	26.5	1.090
F13072	FM	21.2	1.084
FV16210-18	FM	23.6	1.078
FV16213-02	FM	24.7	1.083
Kennebec	FM CK	28.9	1.083
Yukon Gold East	FM CK	23.0	1.088
Red/Purple-skinned			
F12057	FM	26.2	1.080
F12062	FM	21.4	1.071
F12077	FM	33.0	1.083
F13049	FM	24.5	1.089
F13050	FM	27.6	1.082
F13051	FM	29.9	1.080
F13053	FM	29.2	1.087
F13054	FM	31.0	1.084
F13060	FM	30.1	1.085
Chieftain East	FM	28.9	1.076
Norland East	FM	34.5	1.068

The mean percentage of total tuber number in each size category is shown in Table 9.

Table 9: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each fresh market cultivar grown at approximately 209 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
Yellow/White-skinned				
F12051	29	66	5	0
F12059	24	75	1	0
F13047	39	61	0	1
F13058	31	68	1	1
F13063	36	55	2	7
F13065	55	42	0	3
F13072	68	31	0	1
FV16210-18	39	59	1	1
FV16213-02	40	59	0	1
Kennebec	22	65	7	3
Yukon Gold East	21	75	4	0
Red/Purple-skinned				
F12057	57	41	0	1
F12062	48	49	0	3
F12077	30	70	0	0
F13049	51	49	0	0
F13050	54	45	0	0
F13051	35	64	1	0
F13053	30	67	2	1
F13054	18	81	1	1
F13060	36	58	4	2
Chieftain East	23	74	2	1
Norland East	25	70	4	1

The yield of tubers (estimated ton/ac) of each fresh market cultivar is shown by size category in Table 10.

Table 10: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each fresh market cultivar grown at approximately 209 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Yellow/White-skinned				
F12051	2.3	22.8	4.4	0.1
F12059	2.5	22.9	1.1	0.1
F13047	5.0	23.7	0.0	0.5
F13058	3.6	28.1	1.4	0.2
F13063	2.4	16.8	1.3	1.9
F13065	7.7	17.9	0.0	0.9
F13072	9.1	11.8	0.0	0.3
FV16210-18	3.7	18.8	0.9	0.3
FV16213-02	4.0	20.2	0.2	0.4
Kennebec	1.3	19.5	6.4	1.7
Yukon Gold East	1.2	19.8	1.9	0.0
Red/Purple-skinned				
F12057	7.4	17.6	0.5	0.6
F12062	5.4	15.0	0.2	0.9
F12077	4.2	28.6	0.1	0.1
F13049	6.2	18.2	0.0	0.1
F13050	7.1	19.8	0.6	0.0
F13051	3.7	25.2	1.0	0.0
F13053	3.1	24.4	1.5	0.2
F13054	1.8	23.4	0.6	0.3
F13060	1.8	23.1	3.2	1.9
Chieftain East	2.2	24.7	1.2	0.8
Norland East	2.5	27.4	4.1	0.5

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Black scurf was noted on many entries, and affected around 50% of the tubers in samples of F13060, FV16210-18 and FV16213-02.

Conclusions

The 2017 variety trial included a number of cultivars with potential in southern Alberta. Atlantic and Snowden were included in the trial as standard varieties to compare to 5 chipping cultivars. Russet Burbank and Shepody were included in the trial as standard varieties to compare 18 French fry cultivars with. Yukon Gold, Chieftain, Kennebec and Norland were included in the trial as standard varieties to compare with 18 fresh market cultivars.

The trial was designed to provide regional data for a wide range of potato cultivars. All cultivars were planted at the same in-row spacing, the N rate was approximately 209 lbs/ac, and harvest was scheduled for full-season varieties. Addressing the agronomic needs, such as plant density, fertility requirements, and harvest timing for each variety may well result in improvements to yield and size profiles when compared to the results in this trial.

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Alberta Seed Producers Inc.
ConAgra Foods, Lamb Weston Division
Edmonton Potato Growers
Little Potato Company
McCain Foods
Old Dutch Foods
Parkland Seed Potatoes
Prairie Gold Produce
Rockyview Seed Potatoes
Solanum International Inc.
Tuberosum Technologies Inc.

Contact Information:

Michele Konschuh, Ph.D.
Potato Research Scientist
Alberta Agriculture and Forestry, CDCS
301 Horticultural Station Road East
Brooks, AB T1R 1E6
403-362-1314 phone
403-362-1306 fax
Michele.Konschuh@gov.ab.ca

and

Benoit Bizimungu, Ph.D.
Potato Breeder
Agriculture and Agri-Food Canada
Potato Research Centre
850 Lincoln Road P.O. Box 20280
Fredericton, NB E3B 4Z7
506-452-4880
506-452-3316
Benoit.Bizimungu@AGR.GC.CA

Appendix A Plot Plan

